

**AT&T**

# **The UNIX<sup>TM</sup> System User's Guide**



# The **UNIX**<sup>™</sup> System User's Guide

AT&T Bell Laboratories

PRENTICE-HALL, Englewood Cliffs, New Jersey 07632

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Printed in the United States of America

10 9 8 7 6 5 4 3 2

ISBN 0-13-939067-7

ISBN 0-13-939059-6 {PBK.} 025

Prentice-Hall International (UK) Limited, *London*  
Prentice-Hall of Australia Pty. Limited, *Sydney*  
Prentice-Hall Canada Inc., *Toronto*  
Prentice-Hall Hispanoamericana, S.A., *Mexico*  
Prentice-Hall of India Private Limited, *New Delhi*  
Prentice-Hall of Japan, Inc., *Tokyo*  
Prentice-Hall of Southeast Asia Pte. Ltd., *Singapore*  
Editora Prentice-Hall do Brasil, Ltda., *Rio de Janeiro*  
Whitehall Books Limited, *Wellington, New Zealand*

# HOW TO READ THIS GUIDE

The UNIX\* system is a family of computer operating systems developed by AT&T Bell Laboratories and licensed by AT&T Technologies, Inc. Because it can run on many sizes and types of computers and because of all it can do, the UNIX system has gained wide popularity since it was introduced in the late 1960s. Now, either by choice or by fate, you are interested in learning something about it.

This guide is written to help you, the user, understand how the UNIX system works and what it can do for you. It introduces you to UNIX System V, Release 2. New versions of the UNIX system, called releases, will be offered as changes are made or as improvements are added.

## Who Should Read This Guide

Whether you are a newcomer to the world of computers or an experienced computer user who is unfamiliar with the UNIX system, this guide is for you. Although it contains technical material, it can be understood by either a newcomer or an expert. You will find that learning to use the UNIX system requires some thought and time, but you will be rewarded with power and flexibility unattainable with other operating systems.

This guide assumes that you are one of a number of people using a computer on which the UNIX system is running, and that there is a person responsible for monitoring and controlling the UNIX system you are using. This person is the *system administrator*. If, however, you are using the UNIX system on a small computer, you may also act as its system administrator. In this case, in addition to this guide, you should consult the documents you received when the UNIX system programs were delivered to you. (See *Appendix A* for information on how to order additional copies.)

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## HOW TO READ THIS GUIDE

### How This Guide Is Organized

The material in this guide is organized into three major parts: *UNIX System Overview*, *UNIX System Tutorials*, and *Supplementary Information and Reference Tools*. Both the major parts and the chapters in each part are separated by tab dividers.

The following list summarizes the contents of each major part:

- *UNIX System Overview*--This part introduces you to the basic principles of the UNIX operating system. The material in this part is organized into four chapters, each chapter building on information presented in preceding chapters. Therefore, it is recommended that you read chapters 1 through 4 in order. The chapters that make up this part are:
  - *Chapter 1, What is the UNIX System?*--Acquaints you with the UNIX system and explains how it works.
  - *Chapter 2, Basics for UNIX System Users*--Covers topics related to using your terminal, obtaining a system account, and establishing contact with the UNIX system.
  - *Chapter 3, Using the File System*--Explains what the file system is, how you can organize information (data, text, and programs) using the file system, and how you can store and retrieve this information using appropriate commands.
  - *Chapter 4, UNIX System Capabilities*--Builds on material and terminology presented in the first three chapters. It highlights UNIX system capabilities, such as command execution, text editing, electronic communication, programming, and aids to software development.
- *UNIX System Tutorials*--Each chapter in this part takes a step-by-step approach to teach you about one aspect of the UNIX system. You will gain the greatest benefit from them if you work through the examples and exercises at a terminal connected to the UNIX system you will be using. The tutorials assume that

you understand the concepts introduced in chapters 1 through 4. For example, before reading either the *Line Editor Tutorial* or the *Screen Editor Tutorial*, read the explanation of text editors in *Chapter 4*. The chapters that make up this part are:

- *Chapter 5, Line Editor Tutorial*--Teaches you how to use the **ed** text editor to create and to modify text on a paper printing or a video display terminal.
- *Chapter 6, Screen Editor Tutorial*--Teaches you how to use the **vi\*** text editor to create and to modify text on a video display terminal.
- *Chapter 7, Shell Tutorial*--Teaches you how to use the shell to automate repetitive jobs. The shell is the part of the UNIX system that interprets the commands you type.
- *Chapter 8, Communication Tutorial*--Teaches you how to send information to others, whether they are working on your UNIX system or on a different UNIX system.
- *Supplementary Information and Reference Tools*--This part is organized into six appendices, a glossary, and an index. This material contains additional information that you may find useful in learning about the UNIX system. The appendices are:
  - *Appendix A, Selected UNIX System Documentation*--Lists additional UNIX system documentation that enhances or elaborates on the information presented in this guide. This appendix gives document titles, reference numbers, and information on how to obtain the documents.
  - *Appendix B, File System Organization*--Illustrates how information is stored in the UNIX operating system.
  - *Appendix C, Summary of UNIX System Commands*--Describes, in alphabetical order, each UNIX system command discussed in this guide.

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\* The visual editor is based on software developed by The University of California, Berkeley, California; Computer Service Division, Department of Electrical Engineering and Computer Science, and such software is owned and licensed by the Regents of the University of California.

## HOW TO READ THIS GUIDE

- *Appendix D, Quick Reference to **ed** Commands*--Describes the commands used with the line editor (**ed**), first in alphabetical order, and then organized by topic, such as creating text, deleting text, and displaying text.
- *Appendix E, Quick Reference to **vi** Commands*--Describes the commands used with the screen editor (**vi**), first in alphabetical order, and then organized by topics, such as creating text, changing text, and cutting and pasting text.
- *Appendix F, Summary of Shell Programming Ingredients*--Describes shell command language concepts and shows how to use shell programming language statements.

Other sections in this part of the guide are:

- *Glossary*--Defines technical words and terms used in this book.
- *Index*--Gives an alphabetical listing of topics, together with the page numbers on which they appear in this guide.

## Acknowledgements

Many persons, too numerous to mention, contributed suggestions that are reflected in the pages of this guide. These persons include members of AT&T Bell Laboratories and AT&T Technologies, Inc., as well as reviewers and consultants not affiliated with AT&T.

The text of this guide was prepared using UNIX system text editors described in this guide, formatted using the UNIX System Documenter's Workbench\* **troff**, **tbl**, and **mm** macros, and produced on an AUTOLOGIC, Inc., APS-5 phototypesetter operating under the UNIX system.

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# **Chapter 1**

## **WHAT IS THE UNIX SYSTEM?**

### **WHAT THE UNIX SYSTEM IS**

The UNIX system is a set of programs, called software, that acts as the link between a computer and you, its user. The UNIX system is designed to control the computer on which it is running so the computer can operate efficiently and smoothly and to provide you with an uncomplicated, efficient, and flexible computing environment.

UNIX system software does three things:

- It controls the computer,
- It acts as an interpreter between you and the computer, and
- It provides a package of programs or tools that allows you to do your work.

The UNIX system software that controls the computer is referred to as the operating system. The operating system coordinates all the details of the computer's internals, such as allocating system resources and making the computer available for general purposes. The nucleus of this operating system is called the kernel.

In the UNIX system, the software that acts as a liaison between you and the computer is called the shell. The shell interprets your requests and, if valid, retrieves programs from the computer's memory and executes them.

The UNIX system software that allows you to do your work includes programs and packages of programs called tools for electronic communication, for creating and changing text, and for writing programs and developing software tools.

## WHAT IS THE UNIX SYSTEM?

Put simply, this package of services and utilities called the UNIX system offers:

- A *general purpose* system that makes the resources and capabilities of the computer available to you for performing a wide variety of jobs or applications, not simply one or a few specific tasks.
- A computing environment that allows for an *interactive* method of operation so you can directly communicate with the computer and receive an immediate response to your request or message.
- A technique for sharing what the system has to offer with other users, even though you have the impression that the UNIX system is giving you its undivided attention. This is called *timesharing*. The UNIX system creates this feeling by allowing you and other users--*multiusers*--slots of computing time measured in fractions of seconds. The rapidity and effectiveness with which the UNIX system switches from working with you to working with other users makes it appear that the system is working with all users simultaneously.
- A system that provides you with the capability of executing more than one program simultaneously, this feature is called *multitasking*.

The UNIX system, like other operating systems, gives the computer on which it runs a certain profile and distinguishing capabilities. But unlike other operating systems, it is largely machine-independent; this means that the UNIX system can run on mainframe computers as well as microcomputers and minicomputers.

From your point of view, regardless of the size or type of computer you are using, your computing environment will be the same. In fact, the integrity of the computing environment offered by the UNIX system remains intact, even with the addition of optional UNIX system software packages that enhance your computing capabilities.

## HOW THE UNIX SYSTEM WORKS

After reading the past few pages, you know that the UNIX system offers you a set of software that performs services--some automatically, some you must request. You also know that the system creates a certain environment in which you can use its software. But before you can ask the UNIX system to do something, you need to know what it is capable of doing.

Look at *Figure 1-1*. It shows a set of layered circles in graduated sizes. Each circle represents specific UNIX system software, such as:

- Kernel,
- Shell, and
- Programs/tools that run on command.

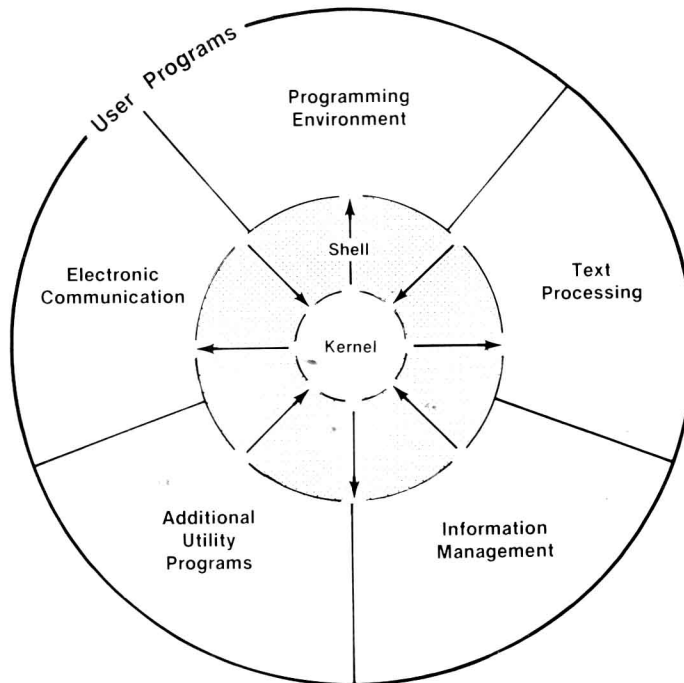


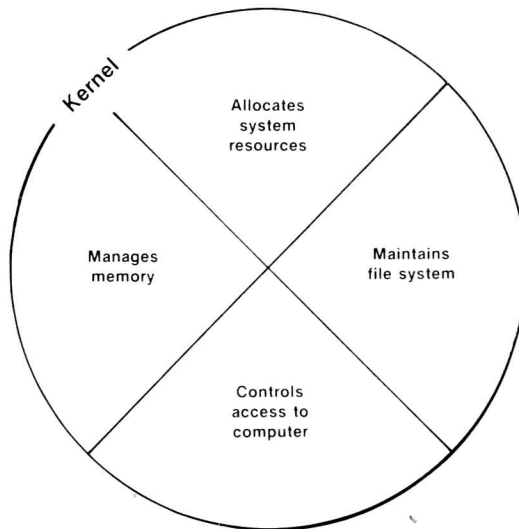
Figure 1-1. UNIX system model

## WHAT IS THE UNIX SYSTEM?

You should know something about the major components of UNIX system software to communicate with the UNIX system. Therefore, the remainder of this chapter introduces you to each component: the kernel, the shell, and user programs or commands.

### Kernel

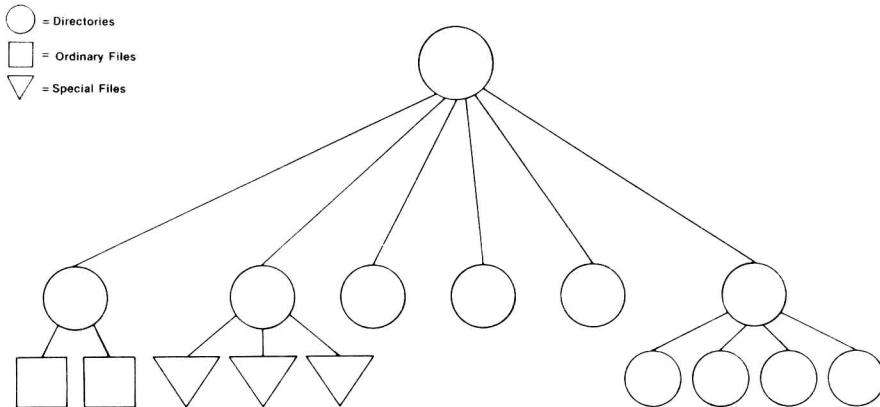
The heart of the UNIX system is called the kernel. *Figure 1-2* gives an overview of the kernel's activities. Essentially, the kernel is software that controls access to the computer, manages the computer's memory, and allocates the computer's resources to one user, then to another. From your point of view, the kernel performs these tasks automatically. The details of how the kernel accomplishes this are hidden from you. This arrangement lets you focus on your work, not on the computer's.



**Figure 1-2. Functional view of kernel**

On the other hand, you will become increasingly familiar with another feature of the kernel; this feature is referred to as the file system.

The file system is the cornerstone of the UNIX operating system. It provides you with a logical, straightforward way to organize, retrieve, and manage information electronically. If it were possible to see this file system, it might look like an inverted tree or organization chart made up of various types of files *Figure 1-3*. The file is the basic unit of the UNIX system and it can be any one of three types:



**Figure 1-3. Branching directories and files give the UNIX system its treelike structure**

- An *ordinary file* is simply a collection of characters. Ordinary files are used to store information. They may contain text or data for the letters or reports you type, code for the programs you write, or commands to run your programs. In the UNIX system, everything you wish to save must be written into a file.

In other words, a file is a place for you to put information for safekeeping until you need to recall or use its contents again. You can add material to or delete material from a file once you have created it, or you can remove it entirely when the file is no longer needed.



## WHAT IS THE UNIX SYSTEM?

- A *directory* is a file maintained by the operating system for organizing the treelike structure of the file system. A directory contains files and other directories as designated by you. You can build a directory to hold or organize your files on the basis of some similarity or criterion, such as subject or type.

For example, a directory might hold files containing memos and reports you write pertaining to a specific project or client. Or a directory might hold files containing research specifications and programming source code for product development. A directory might hold files of executable code allowing you to run your computing jobs. Or a directory might contain files representing any combination of these possibilities.

- A *special file* represents a physical device, such as the terminal on which you do your computing work or a disk on which ordinary files are stored. At least one special file corresponds to each physical device supported by the UNIX system.

In some operating systems, you must define the kind of file you will be working with and then use it in a specified way. You must consider how the files are stored since they can be sequential, random-access, or binary files. To the UNIX system, however, all files are alike. This makes the UNIX system file structure easy to use. For example, you need not specify memory requirements for your files since the system automatically does this for you. Or if you or a program you write needs to access a certain device, such as a printer, you specify the device just as you would another one of your files. In the UNIX system, there is only one interface for all input from you and output to you; this simplifies your interaction with the system.

The source of the UNIX system file structure is a directory known as root, which is designated with a slash (/). All files and directories in the file system are arranged in a hierarchy under root. Root normally contains the kernel as well as links to several important system directories that are shown in *Figure 1-4*:

<b>/bin</b>	Many executable programs and utilities reside in this directory.
<b>/dev</b>	This directory contains special files that represent peripheral devices, such as the console, the line printer, user terminals, and disks.